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A SHORT
HISTORICAL ACCOUNT
OF THE
GREATER PART
OF THE
PRINCIPAL CANALS

IN THE
KNOWN WORLD;

WITH
SOME REFLECTIONS
UPON THE
GENERAL UTILITY OF CANALS;
IN A LETTER

ADDRESSED TO

THE SUBSCRIBERS FOR THE SURVEY OF THE IN-
TENDED NAVIGATION FROM THE EAST TO
THE WEST SEA, BY THE WAY OF NEWCASTLE
AND CARLISLE.

BY R. DODD, CIVIL ENGINEER.

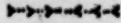
NEWCASTLE UPON TYNE.

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1795.



ADVERTISEMENT.



THE long continuance of the late inclement weather, and the immense quantities of snow upon the ground, have hitherto been insuperable bars to the projected actual survey of the intended Canal between Newcastle and Carlisle; but from the present advanced state of the season, those impediments to the undertaking will in all probability be speedily removed, when the author hopes he will be enabled to present a Report that will merit the approbation of the numerous and respectable subscribers. In the mean time he has taken the liberty of throwing together a few summary remarks on the Canals of the ancients, by whom, even in the dark and ruder ages of the world, works of that nature were beheld with the respect to which their extensive usefulness so amply entitles them. One view in this is, to excite in the bosoms of his countrymen the spirit of national improvement; and by laying before his readers such an example as Peter the Great, (to whose unwearied perseverance even the steril and frozen shores of Russia were disarmed of their severity) he would wish to convince them that difficulties, however great, are overcome by application, and that the art of uniting countries by Canals, though

though known and practised by our forefathers, is still capable of large advances.—Of any emolument arising from this publication, as he did not undertake it with that hope, he will feel no dejection in the disappointment; his utmost aim will be completely answered, if, by compressing into a small compass the sentiments of others on his favorite pursuit, he can afford any amusement to those whose patronage and encouragement it will be his pride and study to deserve.

MARCH 6, 1795.

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A SHORT
HISTORICAL ACCOUNT, &c.

GENTLEMEN,

AS every projector of public undertakings of magnitude and utility would think himself happy to communicate information in the clearest and plainest manner, it has been my endeavour, in the subsequent pages, to convey my ideas without calling in the aid of style, or introducing unnecessary ornament; and as inland navigation is little known in this part of the kingdom, I will first briefly descant on the antiquity of Canals, which were perfectly well known and understood by the ancients.

We find numerous traces of them in ancient Greece, made at so early a period, that the knowledge thereof has been lost for many ages. I think the Persians gave the Babylonians a specimen of their knowledge in canal and drain cutting, when they conquered that proud city. The ancient Romans were too ardently engaged in enslaving the rest of mankind, to leave many specimens of this kind of art behind them. But when we consider they were engaged in almost one continued war, from the foundation to the dissolution of their empire, it is not to be wondered at; as war is, and ever will be, the enemy of art. Diodorus informs us of a Canal cut from the Nile to the Red Sea; which, according

to Herodotus, was begun by Necos, the son of Pfammetichus, and continued by Darius, King of Persia; but was laid aside by the advice of some ignorant persons, who asserted it would lay Egypt under water, because the land was below the level of the Red Sea. How evident it is that those advisers never saw modern Holland! But Ptolemy the second, having more discernment, finished the undertaking; which rendered it one of the first works in the then known world. This Canal was wide enough for two galleys to pass abreast of each other; was termed the length of four days sailing; and was far superior for utility, dimensions, trade, and commerce, to any Canal, at that period, in the universe. The wealth of India, Persia, Arabia, and great part of the kingdoms on the coast of Africa, was brought by shipping to the Red Sea, and by this vast Canal conveyed to the Nile, whence it was distributed by the Mediterranean, not only to Greece and Rome, but to all the surrounding nations. Ourselves, and other northern nations, were supplied from thence, by the Venetians, with those articles, until the Portuguese discovered the way to India by the Cape of Good Hope. Since that period, this Canal has grown much into disuse, and has been, by neglect, laid aside; to which, probably, policy has been the greatest cause. *how are they!*

We have accounts of the beautiful ancient Canal, Faoua, cut from the Nile to Alexandria, by Ptolemy. This Canal had numerous magnificent aqueducts, the ruins of which are remarkably perfect, although it is above two thousand years since they were first erected.

Strabo informs us of a great Canal between Alexandria and Canopus. Herodotus says, the stones for building the Temple of Latona, in Egypt, were brought down this Canal to the Nile;—a distance of nearly two hundred leagues.

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The Canals of the ancients were too numerous to signalize them here; but I cannot leave the subject without observing, that they knew not the use of our modern locks, nor inclined planes, consequently how immense must have been their expence and labour to obtain such long levels!

If we turn our eyes to China, how are we struck with wonder at their grand ideas in Canals, which are also too numerous to describe. I will therefore confine myself briefly to one called the Royal Canal: it is certainly a master-piece of art, and was finished about the year 980. Thirty thousand men were employed on it for forty-three years. It runs nearly North and South; extending from the city of Canton, to the extremities of the empire. By it all kinds of foreign merchandize enter that city, and are conveyed directly to Peking, being a distance of 825 miles; its breadth is fifty feet, and its depth a fathom and a half; and it has brick and stone sides the whole way. They do not, as is usual in this and other countries, give the banks an angle of 45° slope to make them stand; the expence of building those perpendicular walls must have been immense, but they certainly wasted less ground by this process. On this Canal are vessels of great burthen, which sometimes sail, and at other times are rowed with oars, or towed by men.—There are usually about ten thousand sail in this Canal, which pass through, or near, forty large cities. It has 75 vast sluices, or reservoirs, for water; several thousands of draw and other bridges across it; and innumerable Canals are cut from this main trunk, which extend themselves to almost every part of the empire. It is astonishing that the Chinese, a people admired for their ingenuity, have not yet got the method of locks or inclined planes. When they bring a vessel from a lower to an upper level, which is sometimes the

case, they do it by a great number of men heaving at a capstan, tackles, &c. They usually send them from the upper to the lower level by a flush of water, in a race or sluice made for that purpose; by which means they pass like an arrow from the bow. It is a dangerous method, and can only be practised by small vessels. Nothing, that I have ever yet seen, excels the simplicity of the modern lock. All private property, by the law of the land, in China, is obliged to give way to the making of Canals; even the pleasure ground and gardens belonging to the Emperor himself, are not held sacred. In the beginning of new works of this kind, the greatest Mandarin in that part of the country is the first man that puts a spade in the earth; and after an oration from him, the work proceeds. All Canals executed in that country, are done at the expence of its government.—How much better is this than the pursuits of war, of conquest, and dissipation! They have an excellent method of compelling all the criminals to work on those public undertakings; a plan highly worthy the imitation of this country, could something similar to this method be adopted. In reply, it may be said, that it would not be fit work for criminal women: I can affirm for a truth, I have been engaged on a Canal, where I have seen women working with great dexterity, both in filling barrows, and running stages with them; which, I think, is by no means so delicate a sight, as seeing women ascend loaded up ladders, to assist bricklayers; *which is too much to be seen in this part of the country.*—In China one large Canal generally runs through every province; from that a number of smaller ones, which are sub-divided, and extend themselves to every town or village of any consequence in the province. The overflowing of those Canals generally terminates in lakes or large reservoirs, from whence it is drawn, in dry seasons, to flood their
low

low lands, and render their country both beautiful and fruitful. As to the sums that are raised to the Chinese government, from many of these Canals, they are immense. Before I take your attention from this part of the world, I would wish to mention the Ganges and Barrampoo rivers, together with their numerous branches, intersecting the country of Bengal ; which, by the assistance of manual labour, has been made a compleat inland navigation. So equally and admirably diffused are those almost natural Canals, through the country, that there was little left for art to perform. It is supposed that those inland navigations give employment to thirty thousand boatmen ; which will not create surprise, when it is known that all the salt, and a large portion of food, consumed by ten millions of people, are conveyed by water within the kingdom of Bengal and its dependency. Add to this, the transport of commercial exports and imports, estimated at two millions per annum ; the interchange of manufactures, and produce, throughout the whole country, fisheries, and other articles. The vessels made use of in those navigations, are from one hundred and eighty tons, to the size of a common wherry. Those from thirty to fifty tons are reckoned the most eligible for transporting merchandize, &c.

The industrious Hollanders have, with the greatest care and labour, cut a multitude of Canals in every part of the low, swampy, and boggy Provinces they inhabit ; which, before the present unhappy war, in point of commerce, riches, population, and extensive trade, were superior to any other nation on the face of the earth, considering the small space of land they inherited, and one-third of that at least has been gained from the sea, by the means of vast dykes and mounds, made by prodigious labour and at great expence.

The whole country is intersected with innumerable Canals,
and

and may be compared to a number of public roads and highways; as the latter, with us, are continually filled with coaches, waggons, carts, and horsemen, going to and from different cities, towns, and villages; so, in the former, the Hollanders in their boats, pleasure barges, trekschuyts, and other vessels, are continually journeying and conveying goods for consumption or exportation, from the interior parts of the country to their great rivers.— An inhabitant of Rotterdam may, by means of those Canals, breakfast at Delft or the Hague, dine at Leyden, sup at Amsterdam, and return home that night. By them a prodigious inland trade is carried on between Holland, France, Flanders, and Germany; when frozen over, they travel on them with skaits, and perform long journeys in a short time: Heavy burdens are conveyed on carts, sledges, and ice-boats. The yearly profits produced by those Canals are almost incredible: But it is certain they amount to more than 250,000*l.* for about forty miles of inland navigation, which is 625*l.* per mile; the square surface of which mile is not quite seven acres and a half of ground; a profit so amazing, that it is no wonder other nations should attempt to imitate them.

The Canals of Ostend, Ghent, and Antwerp, are much out of condition; there is not that commerce on them there used to be; but the country round them possesses great wealth, and is extremely populous.

The cities in Flanders are by no means in the flourishing state they were in some centuries past; their Canals were then numerous and kept in good order, and were filled with vessels laden with merchandize from every part of the world.— But Holland on one side, and France on the other, have not only encroached on their territories, but diminished their trade.

trade. The city of Amsterdam rose to opulence on their decline.

The Canals in Holland are generally sixty feet wide, and six feet deep. They are cleansed from time to time, and the mud sold for manure, which produces great profit.— Their Canals are generally upon a level: Of course, locks are not necessary.

The more northern countries of Denmark and Sweden cannot be noticed for numerous Canals; yet Sweden has been at great expence and labour to make some of her rivers navigable, and has succeeded in part. As to their Canals in general, they have been exceedingly unfortunate, the face of the country being so much against them. One Polham, an engineer, spent them many thousands by his chimerical schemes. To enter into what he did, would be neither instructing nor amusing. One of the best Canals they have is the Carlsgraf, begun by Charles the ninth, part executed by Charles the twelfth, part by Adolphus Frederick, and finished by Gustavus, in 1768.

In Denmark the junction of the two seas is formed by the Canal of Kiel, through the Duchy of Holstein, runs into the river Eyder, passes Rindsburgh, and falls into the German ocean at Tonningen. The Canal begins about three miles north of Kiel, at the mouth of the rivulet Lewensawe. The distance from its beginning to its last sluice at Rindsburgh is twenty-seven English miles; and of six miles and a half of the river made navigable, only twenty miles and a half were cut. It was begun in the year 1777. The utility of this Canal is evident, in preventing many vessels from taking the circuit round Jutland. Vessels not exceeding one hundred and twenty tons, nor drawing above ten feet water, may pass immediately from the Baltic to the German ocean. When

Peter

Peter the Great, Czar of Moscow, was in Holland, he was struck with the industry of the inhabitants, and the ingenuity of making their Canals, whereby they raised a small, marshy tract of land into a populous and powerful state. That great Prince, when he returned into his own country, formed some of the grandest designs for inland navigation through Russia, by which he could convey the rich commodities of Persia to his new city of Petersburg. They were first to be transported by the Caspian sea to Astracan, and thence to the mouth of the river Wolga, and by a junction of Canals into the river Mesta, and the lake Novogorod, and thence into the lake Ladoga, and by the river Neva to Petersburg, being a course of 460 miles. He likewise projected a communication between the rivers Don and Wolga, which were to join the river Occa by another Canal, and thus effect a navigation to Moscow by the river Mosca, and afterwards by several other Canals of communication, through the river Divina, to the city of Archangel, on the White Sea; and lastly, the commodities from Archangel and the adjacent countries were to be conveyed through the river Onega, to lake Onega, by a Canal; and also through lake Ladoga, which lies at the foot of the Gulph of Finland, by the river Neva, to Petersburg.

The death of this Monarch prevented the completion of these grand undertakings; but they have been in great part executed since that period. They were begun in the year 1698, by a German engineer, named Breckell, who had little judgment in Canal cutting. During the first year he had 12,000 men under his command, digging, &c. Most of their labour was lost in one night. He fled the country, fearing the Czar's resentment, who immediately employed, at a liberal salary, a Mr John Perry, an Englishman, a person

person well acquainted with river navigation, and well qualified for carrying on the greatest works ; he rendered Russia essential services by his abilities ; and what was left undone by Peter the Great, has been carried on with the utmost assiduity by his successors.

A communication is now effected between the Baltic and the Caspian seas, by which a navigation is now opened to Persia. A new communication with the river Wolga is likewise undertaken. Several other works of this kind are carrying on for the benefit of trade and commerce, by order of the present Empress. The immensity of the inland navigation in Russia may be judged of from some of their Canals ; to mention all would be tedious. In the year 1778, four thousand nine hundred and twenty-seven vessels passed through the Canal of lake Ladoga. Some of the most rapid rivers in Russia (occasionally navigated) are the Twertza, near Apezenskoe Radok, of so rapid a current, that vessels shoot along within the hour frequently twenty miles ; the fall of the river in this place is one hundred and twenty-two yards and a half perpendicular in twenty miles. There is, perhaps, no part of the world in which inland navigation is carried through such an extent of country as in Russia ; it being possible, in that empire, to convey goods by water, 4472 miles, from the frontiers of China to Petersburg, with an interruption of only about 60 miles ; and from Astracan to the same capital, through a space of 1434 miles ;—a most astonishing track of inland navigation !

Very numerous are the Canals in France already constructed, and they have many more in agitation. The first which history gives us an account of was projected by Lucius Verus, who commanded the Roman army in Gaul, under the Emperor Nero, to join the river Moselle with the Rhine. The

Canal of Briare, called also the Canal of Burgundy, was begun under Henry the Fourth, and finished in the reign of Louis the Thirteenth. It forms a communication between the Loire and the Seine, and, consequently, to Paris. It begins from the Loire at the town of Briare, passing by Châtillon-sur-Loing, to Montargis, where it takes the name of the Canal of Montargis; just above which town it joins the Canal of Orleans, and thence proceeds on, in one Canal, by Chau, Landau, Nemours, and Mout, and falls into the Seine near Fontainebleau. It is of the greatest utility to all this part of France, and even to Burgundy. This Canal has forty-two locks and sluices; and by it Paris is supplied with corn, flour, and provisions, as well as the other productions of several provinces. The Canal of Orleans, which joins this Canal near the town of Montargis, was begun in 1675, to effect a communication between the Seine and the Loire near to the city of Orleans. It is considerably shorter than the Canal of Briare, and has only twenty locks and sluices. By this Canal the inhabitants perform an inland navigation in their bateaux-coches, (coach-boats or water coaches) a voyage (or journey) to the neighbouring towns, and even to the city of Paris itself. These vehicles set out at stated times and places for the convenience of passengers and conveyance of all sorts of goods; they are large and covered, and exceedingly well adapted for the purpose. The Canal of Languedoc, called also the canal of the two seas, which forms a junction between the ocean and the Mediterranean, was first projected under Francis the First, but begun and finished under Louis the Fourteenth: It does honour to the able minister Colbert, and to Riquet the engineer who conducted the work. This amazing undertaking was begun in 1666. It has answered almost every expectation formed
from

from it, and has established a ready communication between the two fertile provinces of Guienne and Languedoc. This Canal extends from Narbonne to Thoulouse. It receives several little rivers as feeders in its way, and is provided, at proper intervals, with one hundred and fourteen locks and sluices. In some places it is conveyed by aqueducts over bridges of incredible height and strength, which under them give passage to other rivers. Near the town of Beziers it was conveyed under a mountain by a tunnel (a method which has now become common) 720 feet in length, cut into a lofty arcade, and the greatest part of the way lined with free-stone, excepting towards the ends, where it is only hewn through the rock, which is of a soft sulphurous substance. The expence of this work was thirteen millions of livres, about five hundred and forty thousand pounds sterling; of which the King contributed seven millions, and the province of Languedoc the remainder. This Canal begins at Cette in the Bay of Languedoc; its length between Port de Cette, on the Mediterranean and Tholouse, is 152 English miles, besides a river navigation from Thoulouse to Bourdeaux, which is above 100 miles more; so that the whole length of inland navigation is above 250 English miles between the sea-ports. Its breadth is 144 feet, and its depth 6 feet. The expence of this astonishing work was nothing in comparison with its utility; it was executed mostly by the disbanded soldiers and seamen on the reduction of the French army and navy after a war.

I will just mention the number of Canals already executed, and some others projected.—The number executed is 32, and 23 more are projected; some of which have been begun even since France has been involved in her present troubles.

Spain is a vast body without substance, which has greater

riches than strength. The mines of Mexico and Potosi furnish that kingdom with means to purchase every thing except liberty ; but Bigotry and Superstition, together with the Inquisition, prevent the subjects of other countries from emigrating to it, and population is far from being encouraged ; the pride of the Spaniards will not permit them to cultivate their lands, which are some of the finest in Europe, nor to apply themselves to commerce ; and, notwithstanding all their riches, their country is barren, and the body of the people poor and miserable.

The internal parts of Spain are as capable as, if not more so than, any country in Europe, of receiving the improvements of inland navigation, and there is no country in the world to which they are more necessary. The great rivers Ebro, Guadalquivir, Guadiana, Tagus, Duero, and Minho, rise in the middle of the kingdom, and run into the ocean and Mediterranean : And there are besides many others of less note, from which navigable Canals might be made to intersect the interior parts of the country, at a very reasonable expence. The profit of such undertakings would be immense ; for it will scarcely be believed, that even in this enlightened age, the Spaniards carry the products of the interior parts of the country, which chiefly consist of wine and oil, in large leathern bottles, on the backs of mules and asses, from one province to another. Grain also is conveyed in like manner to those parts of the country which grow none, although the climate is perhaps the finest in the world. Spain has, however, made some attempts in the way of Canals to improve some interior parts of the country. In the year 1785 the famous Canal of Arragon began to justify the hopes which had been entertained of it. Since the reign of Charles the Fifth some small vessels from Tudela arrived at Saragossa,

Saragossa, where they were received with the most lively demonstrations of joy. The country or province of Arragon is already planted with thousands of olive and other trees. The cities and towns, which formerly were condemned to drought and scarcity, are now supplied with fish and water from these Canals; Spain has had many other Canals projected by a French engineer named Le Maur: She has had some begun, which, through bad management, have been laid aside.

In Spanish South America it has frequently been proposed to cut a canal through the Isthmus of Darien, from Panama to Nombre de Dios, to effect a ready communication between the Atlantic and South Seas, and thus open a straight passage to China and the East-Indies; an immense idea;—and, I doubt not, will some day be executed.

In Pennsylvania, North America, the river Swetara, which falls into the Susquehanna from the north-east, is navigable fifteen miles. It is now in contemplation to cut a Canal about twenty miles from the river Swetara to the river Tulpehocken, a branch of the Schuylkil. Should this be effected, a passage would be open to Philadelphia from the Juniatta, the Tyoga, and the east and west branches of the Susquehanna, which water at least 15,000,000 acres. From this junction the general course of the river is about south-east, until it falls into the Chesapeake Bay, just below Havre-de-Grace: It is about a mile wide at its mouth, and is navigable for sea-vessels only about twenty miles, on account of its rapids. The banks of this river are very romantic, particularly where it passes through the mountains: This passage has every appearance of having been forced by the pressure of the water, or burst open by some convulsion of Nature. Several improvements are carrying on in the Straits of Virginia,

ginia, which will terminate near the new-intended city of Washington. Early in the year 1785 the Legislatures of Virginia and Maryland passed acts to encourage opening the navigation of this river. It was estimated that the expence of the Canals and other works would amount to 50,000*l.* sterling; and ten years were allowed for their completion. At present the President and Directors of the Incorporated Company suppose that 45,000*l.* will be sufficient for the undertaking, and that it will be accomplished in a shorter time than was estimated. Numerous are their other projected Canals; some for connecting lakes with rivers, and others for nearer communications from the east to the great river Mississippi and Ohio. In some parts in which I have been on that vast continent, I have seen small rivulets crossing flat grounds like Canals, cut by Nature: Never did I see a country better qualified for inland navigations. There is one essential article in their favour, that if they be judiciously managed, they never can want water.

As so many Europeans are constantly emigrating to her as to a land of Peace, her population must soon become very considerable; and as a spirit of emulation is sprung up among the natives for improving their country, there is no doubt but canal cutting will be carried to the greatest perfection amongst them: I think the greatest proof of it is, their so early beginning works of this kind after a distressing and expensive war with this country.

Ireland is not without her Canals; but I shall principally treat on the one from Dublin to the river Shannon, which was originally planned by Mr Omes, (the engineer to the Lagan navigation) and carried on under his directions from Dublin into the Bog of Allen, at the expence of 77,000*l.* When the work was advanced thus far, it was discovered that
several

several capital mistakes had been committed in the levels,—the water in some places of the Canal standing four or five feet deeper than in others* ; in consequence of which mistake, the work being almost at a stand, in the year 1770 the Members of the Right Honourable Navigation Board called in Mr Vallancy, who vainly subscribes himself “ Director of Engineers,” to survey the works, and advise what was proper to be done ; but not being satisfied with Mr Vallancy’s Survey and Report, they called in Mr Tait, engineer, who differed very widely from Mr Vallancy in almost every part of his Survey and Report ; and has in general assigned good reasons for so doing. Since that time some other engineers have been consulted, and vast sums of money have been expended on this Canal. The failure of this great work, which at first might have been so very easily completed at a moderate expence, may justly be attributed to the want of an accurate and well-digested Plan and Survey ; for it does not appear there were any material difficulties in the whole line, but what might have been overcome with great ease had the work been properly conducted. The course of this Canal is from the city of Dublin, over the rivers Little Morrell and Great Morrell, and then across the river Liffy, by Dowlingo and the Isle of Allen into the Bog of Allen, and into the

* From the best authority I can assert, that at the Meeting at Hexham, a Gentleman hinted he could wish to send for, and employ, persons from Ireland at three guineas per day, as levellers in the line of our intended navigation. Should that be the case, I hope we shall have better specimens than those given on the Dublin Canal.—I presume the levels I shall produce in my Report, though taken by a native of this country, on investigation, will be found as accurate as any taken by Hibernians.

river

river Maiden at Tullimore, which goes into the Brusna river, and falls into the river Shannon, near Moys-town. A Canal is cut out of the Grand Canal in the middle of the Bog of Allen, into the river Boyne, at Edinderry, and another near Clonbullock, into the river Barrow to Moneasteraven, and into another branch of the same river at Portarlinton; another cut is also made to Naastown; and a fourth to Johnstown: Several more cuts, equally useful, are in contemplation, the navigation being far from complete. The whole length of the cut from Dublin to Shannon is sixty-one miles and a half.

I have before observed that the expence of carrying this Canal through the Bog of Allen in the year 1770, when a stop was put to it till further and more accurate Surveys should be taken, was 77,000*l.*; New Surveys have been since made, and other engineers appointed; but notwithstanding the vast quantity of money laid out, or rather squandered away upon it, it still remains, in some measure, unfinished.—Arthur Young, Esq; Fellow of the Royal Society, in his travels through Ireland in the year 1790, says, that from authentic information, this Canal, with all its faults and blunders, has already cost above half a million of money, yet it was still, at that period, far from being complete; and is, in fact, what may be called a mere job. Considerable sums of money have been spent to render the Newry Canal perfect. The Irish have taken the greatest pains to render many of their rivers navigable; the best proof is the liberal sums the Irish Parliament have granted for that purpose, since the year 1753, which, from a copy of the Irish Journals in the House of Commons, appears to be 329,101*l.*;—an evident proof that they have ever been very liberal to serve public undertakings.

In treating on Canals in this our own island of Great Britain, I think it expedient that I should mention the first one executed called Cardyke, as it is the most ancient ; but whether it was intended for the purpose of inland navigation, is impossible to be determined, different authors having assigned to it different uses ; but as it is cut from the river Nyne, a little below Peterborough, into the river Witham, three miles below Lincoln, there is great reason to suppose that it was intended to join the two rivers. It is probably a work of the Romans, and was forty miles in length, though it is now almost filled up, and must have been very deep.—Some authors, however, suppose it to have been cut by the Danes. Moreton will have it to have been made under the Emperor Domitian, and urns and medals have been dug up near it, which seem to confirm this opinion. The Canal for supplying London with water, commonly called the New River, was projected and begun by Mr (afterwards Sir Hugh) Middleton in the year 1608, and finished in five years. This Canal begins near Ware, in Hertfordshire, and takes a course of sixty miles, before it reaches the grand cistern at Islington, which supplies the several pipes that convey the water to the city and parts adjacent. Near Hornsey it was formerly conveyed over a valley, between two hills, by means of a wooden trough supported by wooden props, and about 23 feet in height ; but, of late years, the course has been changed, and the river embanked. In other places, meandering round hillocks and rising grounds, it is confined on one side by the solid hill, and on the other by large thick banks, piled, or large mounds.

The Sanky Brook Canal was cut from St Helen's to the river Mersey in the year 1755 ; which proves it to be a prior work to that noble undertaking of the Duke of Bridgewater.

It was planned and executed by Mr John Eyes, a person, who, I believe, never saw a Canal in his life before. He possessed a considerable share of ingenuity, and got through the work with credit to himself, and satisfaction to his employers. This Canal leads from the coal pits at St Helen's, near Prescot, to connect with Liverpool by the river Mersey; and was cut to convey coal for the accommodation of the latter place. Near this Canal are the large copper works belonging to the Anglesea Company, and also the glass-works, called the Lancashire plate-glass-works. The length of the Canal is twelve miles, with ninety feet fall. The Act of Parliament for making this Canal, was obtained in 1755, and impowers to render the Brook, called Sandy Brook, navigable. I should not have called your attention to this small Canal, had it not been to correct the mistake that some have entertained, that the Bridgewater navigation was the first executed in this country, for the purpose of working vessels thereon. His Grace of Bridgewater obtained his Acts for his projected navigation in the years 1758 and 1759, which was begun and so happily executed under his Engineer, the ingenious Mr Brindley, a man, who, previous to that period, was totally unacquainted with Canals. From his never being abroad, it was impossible he could see them, and from the poverty of his education, it was impossible he could learn much from books. But nature was more liberal to him in other ways; difficulties which appeared like mountains to other men, seemed to him but as mole hills. In short, whatever he undertook, he generally executed with the greatest success. The first design of this Canal was for conveying coals from a mine in his Grace's estate to Manchester; but it has since been applied to many other useful purposes of inland navigation. This Canal begins at a place called Worsley Mill, about seven computed miles from Manchester,

chester, where the Duke has cut a bason capable of holding, not only all his boats, but a great body of water, which serves as a reservoir, or head of his navigation. The Canal runs through a hill, by a subterraneous passage, big enough for the admission of long flat-bottomed boats, which are towed, by hand-rails on each side, near three quarters of a mile under ground to the coal works. There the passage divides into two channels; one of which goes 500 yards to the right, and the other as many yards to the left, and both may be continued at pleasure. The passage is in some places cut through the solid rock, and in others arched over with brick. Air funnels, some of which are 37 yards perpendicular, are cut, at certain distances, through the rock to the top of the hill. The arch, at the entrance, is about six feet wide, and more than five feet high above the surface of the water. It widens within, so that, in some places, the boats may pass each other; and at the pit it is ten feet wide. The coals are brought to this passage, or Canal, in little low waggons, that hold nearly a ton each; and, as the work is on the descent, are easily pushed or pulled along, by a man, on a railed way, to a stage over the Canal, and then shot into one of the boats, each of which holds seven or eight tons. They then, by means of the rails, are drawn out, by one man, to the bason at the mouth (a boy of seventeen years of age has worked twenty-one of these boats at a time, which at seven tons each, the lowest quantity, is 147 tons brought from the pit to the bason, at the entrance); then five or six of them are linked together, and drawn along the Canal by a single horse, or two mules, on the banks or towing paths; it is there broad enough for the barges to pass or go a-breast; and in the course of nine miles (a circuit of two miles being made in seeking a level) the Canal reaches Manchester.

The Canal is carried over public roads by means of arches ; and where not sufficiently high for a carriage to go under, the road is lowered with a gentle descent, and ascends on the other side. It is carried over the navigable river Irwell, and nearly forty feet above it ; so that large vessels, in full sail, pass under the Canal, as under a large lofty bridge, whilst the Duke's barges are at the same time passing over them. It may be proper here particularly to describe the noble aqueduct which carries this Canal over the river Irwell. At Barton-bridge, three miles from the basin, begins this aqueduct, which, for upwards of two hundred yards, conveys the Canal across the river and along a valley : there are also stops at each end, that may occasionally be drawn up, and the whole intervening body of water let off ; which is easily done by drawing a plug, and discharging the water into the Irwell through a wooden tube. There are many of these stops, or flood-gates, so constructed, that should any of the banks give way, and thereby occasion a current, they will rise by that motion, and prevent, as well the great loss of water, as the damage that would otherwise happen by overflowing the country. This bridge unites the Lancashire and Cheshire parts of the Duke's navigation, which is carried over the meadows on each side the river Mersey, and quite across Scale Moor, at incredible labour and expence. Mr Brindley caused trenches first to be made, and then placed deal balks in an upright position, from thirty to thirty-six feet long, backing and supporting them on the outside by other balks laid length-ways, and in rows, and screwed fast together, driving in some thousands of oak piles, of different lengths, between them ; and on the front side he threw the clay and earth, and rammed them well together, to form his navigable Canal. After thus finishing forty yards, he removed the balks, and proceeded again as before, where it was designed to continue the

the Canal. An ingenious method was used to fill up the bed of the Canal to a proper level. Two long boats were fixed within two feet of each other; between and over them was erected a trough, large enough to contain eighteen tons of rubbish. The bottom of this trough was a line of doors, which, upon drawing a pin, burst open, and in an instant discharged the burden. The usefulness of this contrivance is evident; from a near convenient spot the boat was loaded, in a short time drawn to the place wanted, and in a few minutes the whole contents were properly deposited.

The Bridge for the aqueduct over the river Irwell is built all of stone, of great strength and thickness. Every stone in the faces has five square beds and sides, well jointed and cramped with iron cramps. There are three arches over the river Irwell, which, with their piers, are all of hewn stone of the largest dimensions, and cramped in the same manner as the others. The centre arch is sixty-three feet wide, and thirty-eight feet above the water, and will admit the largest barges, which navigate the Irwell, to go through with masts and sails standing. At Combroke, three miles further, is a circular wear to raise the water of the Canal to its proper height: the supply flows over the nave of a circle in the middle of the wear, built of stone, into a well, and, by a subterraneous passage, is conveyed to its usual channel: there is, also, a machine to wash the slack, which is worked by water. In order to feed that end of the navigation which is near Manchester, Mr Brindley raised, and as it were swallowed up, the river Medlock, by a large beautiful wear, composed of six segments of a circle, built of square stone, bedded in terras, and every stone cramped with iron: the whole circumference is 366 yards, with a circular nave of stone in the middle. The water, when more than sufficient to supply the
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the navigation, flows over the nave, and down the well as at Combroke; but in order to keep the bed dry during the time the workmen were building this wear, he turned off the greater part of the water by a cut through the rock. From the wharf at this place, the poor of Manchester fetch great quantities of coals in wheel-barrows, at three-pence-halfpenny a hundred weight of seven score, which is not one half the price which was before paid for that necessary article. But Mr Brindley, to remove the inconvenience of carrying them up Castle-hill, cut a large funnel through the centre of this hill, into which the barges are introduced; and by a crane, which is worked by a box water-wheel of 30 feet diameter, and four feet four inches wide, they are landed close to the town. This branch of the Canal, to Manchester, is near ten miles in length, and has been executed, on an average, at the expence of a thousand guineas a mile. At Langford Bridge, the Canal turns away to the right, and, crossing the river Mersey, passes near Altringham, Dunham, Grapenhall, and Haulton, into the side-way of the river Mersey at Runcorn-Gap, where his Grace's barges can come into his Canal from Liverpool. The ingenuity and contrivance displayed through the whole work are wonderful. The smiths' forges, the carpenters' and masons' work-shops, were covered barges, which floated on the Canal, and followed the work from place to place; by which means there was very little or no hindrance of business from accidents; and as the Duke had all his materials in his possession, timber, stone, lime, and coals, from his own estates, and ready at hand, he has been at little expence except labour. The above navigation is more than 29 miles in length; and, in many places, is eight yards wide, and four feet deep. From Worsley to Manchester, and Preston Brook, is 29 miles, 2 furlongs, at
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one level; from Preston Brook to Low Water, at Runcorn, 95 feet fall; and the branch to Stockport, 7 miles, 4 furlongs, level, and 60 feet rise: astonishing as this work was, the whole was completed in five years. The utility and profits were soon perceived by a discerning and trading people; and a number of applications were made to Parliament for different Acts to join the four great trading marts, London, Bristol, Liverpool, and Hull, by an inland navigation, with branches to different manufacturing towns; in all of which they happily succeeded. I am happy to say that Canals in this country, already executed, are too numerous to be treated on at large in a short work of this kind; I shall only, therefore, mention, that, since the year 1755, above fifty Acts of Parliament have passed for different INLAND NAVIGATIONS.

I have often been astonished that canal navigation was so long before it was established in Great Britain, when we saw such lively examples of its utility in the surrounding nations. I think the only apology, if it might be termed one, is, in the bountiful hand of Providence scattering so many rivers in it. From the best authority we are told, "the ground was cursed for man's sake." I am sure part of the rivers are included in it; for they, like the ground, without great pains and labour, yield man but little profit. In this I confine my ideas to those of shoal water; but these, when properly managed, always yield the surrounding country the greatest benefit. If we are to make the supposition of two states, the one having all its cities, towns, and villages, upon navigable rivers and canals that have an easy communication with each other; the other possessing only the common conveyance of land-carriage; supposing, at the same time, both states to be equal as to soil, climate, and industry; commodities and manufactures
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in the former state might be expected thirty per cent. cheaper than in the latter ; or, the first state would be a third richer, and more affluent than the second ; which is one of the chief causes of the great wealth of China and Holland. The last-mentioned countries have systematically encouraged Canals and inland navigations at the public expence, and neither of them are wanting in wealth, trade, or population.

Arguments have been used by the enemies to Canals in this country, that inland navigations tend to diminish the number of our seamen ; I have often heard assertions of this kind made, but never yet met with a person who could give a demonstration of it ; for Canals have not only been the means of enlarging our foreign commerce, but also of breeding numerous and useful bargemen and boatmen. Although they are not capable of being ranked with able seamen, it is evident that, in that line, they learn the use of oars, sails, and steering. I think, from the declaration of the present minister, it is evident he means to adopt their usefulness on board his Majesty's ships of war for the defence of the country. There is another argument used against Canals, which is, that they waste too great a portion of the land in the countries they pass through. But let it be remembered, that one mile of Canal, fourteen yards broad, takes up little more than five acres of land, and on this Canal one horse can draw more than thirty on the best of turnpike roads. It may be fairly inferred from this, that the public are savers of 29 horses out of 30 ; add to which, that the saving of oat lands, which might be cultivated for better purposes ; and, besides, how many thousand pounds are annually paid out of this country for the importation of foreign oats, which the universal adoption of Canals in the country will do away ? As I have before observed, Canals have not only been the means of
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enlarging our foreign commerce, but of giving birth to an extensive internal trade, which, with all the advantages attendant on foreign commerce, has, perhaps, far exceeded it in extent, value, and importance.

So great has been the effect which these Canals, and the trade to which they have given birth, have had on our industry, population, and resources, that in many instances they have entirely changed the appearances of the country through which they pass, which I am confident will be the case between here and the West Sea, whenever our intended navigation is put in execution. The reasons of this change are sufficiently obvious: As consumers, by means of Canals, we are enabled to import more cheaply; as producers, we export with greater facility. Do the materials of a manufacturer lie dispersed? Canals unite them, and at the same time supply the persons employed with every necessary at the cheapest rate: And the land-owner, whether we consider the surface of the soil, or the mines in its bowels, necessarily finds his advantage from new markets, and from having a cheaper carriage both for his productions and his manure. To the cheapness of conveyance, compared with land-carriage, may be added the advantages attendant on an easy and secure communication with the different parts of the country, during the tempestuous months of winter, and in times of war.

Canals and navigable rivers, by diminishing the expence of carriage, put the remote parts of the country more upon a level with those in the neighbourhood of large towns; they are, on that account, the greatest of all improvements: They encourage the cultivation of the remote parts, which are always the most extensive circle of the country; and thereby rents are much improved: They are advantageous to towns, by breaking up the monopoly of the country in their neighbour-

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hood: And they are advantageous to all parts of the country; for, though they introduce some rival commodities, they open many new markets for their produce.

When a navigable Canal has been once made, the management of it becomes quite simple and easy; and with respect to the making, it is reducible to strict rule and method: It may be contracted for with undertakers at so much per mile, and so much per lock: Such undertakings, therefore, may be, and accordingly frequently are, very successfully managed by joint-stock companies. Lighters and barges, which are used on a navigable Canal, pay toll in proportion to their weight or their tonnage; they pay for maintaining those public works in proportion to the wear and tear which they occasion: A more equitable way of maintaining such works cannot be found; for the tax or toll, though advanced by the carrier, is finally paid by the consumer. In short, all Canals may be considered as roads of a certain kind, where one horse can do the labour of 30 or 40 on the modern roads with modern carriages. Bad roads, and a difficulty of communication between places remote from each other, occasion a kind of sterility in a country, and render most things much dearer and scarcer than they would otherwise be; but even the best of roads are not one-tenth part the value of Canals, where the face of the country will admit of them: The latter, upon a small scale, I have seen executed, in some flat countries, at much less expence per mile than some turnpike roads, and frequently kept in repair at one-tenth part of the expence. Canals which are the property of a company of subscribers, will be constantly kept in repair, for their own interest obliges them to it; if not, the navigation ceases, with their profit as well as principal. With respect to the profit of some Canals to the share-holders, it is astonishing: In one
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of the first executed Canals in Yorkshire, the proprietors draw, at this moment, about 250l. per cent. per annum on the shares originally subscribed, that is to say, for every 100l. originally subscribed, is drawn an annual income of 250l. The profits of the Birmingham, and many other Canals in this kingdom, are immense; which are frequently the occasion of rival Canals amongst them, and have caused a reduction in the profits of others. But attempts of this kind can never succeed in opposing that projected between Newcastle and the West Sea; as Nature seems to have pointed out one general line only, wherein there is any apparent practicability of its passing without enormous expences; great part of this line possesses greater advantages by being nearer the inhabited towns and humble vallies, than a person from Ireland of elevated ideas, who has lately written thereon, seems to think: For, let me add, that however specious it may appear on paper, to carry a Canal over hills and dales, at an enormous expence, and thereby disdainfully rejecting six miles of navigation, which Nature has already bountifully given us at this end of the line, I presume I shall make it appear, in my Report, that his arguments are illusive.

The publication of that Report shall be effected as speedily as possible, and delivered to the subscribers as originally determined on at the General Meetings.

I am, GENTLEMEN, with the greatest respect,
Your humble servant,

R. DODD.

Newcastle, Feb. 28, 1795.

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